C L A I M S

1. A test system for a mobile communication terminal, comprising:

a test procedure control unit which possesses a procedure for carrying out a transition test for a connection state of a mobile communication terminal of a cellular system, and which outputs control information including time setting information in accordance with the procedure;

a transmission/reception unit which, in accordance with the control information from the test procedure control unit, generates a plurality of test signals including predetermined messages corresponding to a plurality of cells in the cellular system, and which varies the plurality of test signals in accordance with a scheduled time passage to thereby transmit the signals to the mobile communication terminal and receive response signals including predetermined messages from the mobile communication terminal;

a reception measurement unit which measures time domain waveforms of the response signals including the predetermined messages from the mobile communication terminal;

a message log acquiring unit which acquires and stores messages and radio-communication time information when the transmission/reception unit and the mobile communication terminal exchange the

respective predetermined messages;

a display unit which displays measured results of the time domain waveforms from the reception measurement unit and the radio-communication time information from the message log acquiring unit; and

a display control unit which carries out processing for receiving the measured results of the time domain waveforms from the reception measurement unit and the radio-communication time information from the message log acquiring unit, and for causing to display graphs indicating the measured results of the time domain waveforms and a predetermined number of radio-communication markers indicating points in radio-communication time which correspond to the radio-communication time information by a graphic display capable of simultaneously comparing at both sides of the same time base on the display unit.

2. The test system for a mobile communication terminal, according to claim 1, wherein the display control unit has:

a coordinate generating unit which divides a display screen of the display unit into at least a first region and a second region, and which causes to display a first coordinate where the abscissa is time and the ordinate is power level at the first region, and causes to display a second coordinate where the abscissa is a time base which is the same as the

abscissa of the first coordinate and the ordinate is positions of the mobile communication terminal and the plurality of cells at the second region;

a data display control unit which causes to display the graphs indicating the measured results of the time domain waveforms at the first coordinate displayed by means of the coordinate generating unit; and

a radio-communication marker generating unit which causes to display a predetermined number of radio-communication markers indicating points in radio-communication time which correspond to the radio-communication time information along the abscissa which is a time base of the second coordinate displayed by means of the coordinate generating unit.

3. The test system for a mobile communication terminal, according to claim 2, wherein the radio-communication marker generating unit, as the predetermined number of radio-communication markers, between the mobile communication terminal and respective positions of the plurality of cells on the ordinate in the second coordinate, causes to display capable of recognizing at least one of down radio-communication from the mobile communication terminal to one of the cells and up radio-communication from one of the cells to the mobile communication terminal, and capable of recognizing the points in

radio-communication time which correspond to the radio-communication time information along the abscissa which is a time base of the second coordinate.

4. The test system for a mobile communication terminal, according to claim 2, wherein the reception measurement unit has a function of measuring a transition time that, in accordance with a response signal from the mobile communication terminal, until it is switched from a state in which the mobile communication terminal receives a first test signal showing a greater strength at a current point in time among the plurality of test signals to a state in which the mobile communication terminal receives a second test signal having a second greater strength among the plurality of test signals accompanying that the plurality of test signals are varied to be successively made to be a greater strength in accordance with the scheduled time passage,

the test system for a mobile communication terminal further comprises a determining unit which, upon receiving the measured results of the transition time from the reception measurement unit, carries out success/failure determination as to whether a transition has been a success or a failure in which the mobile communication terminal switches from a state of receiving the first test signal to a state of receiving the second test signal among the plurality of test

signals corresponding to the plurality of cells in accordance with the control information from the test procedure control unit, and

the data display control unit causes to display capable of recognizing a success/failure as a result of the success/failure determination by the determining unit together with a corresponding radio-communication marker among the predetermined number of radio-communication markers displayed by means of the radio-communication marker generating unit.

5. The test system for a mobile communication terminal, according to claim 2, wherein the data display control unit causes to display capable of recognizing states from a start up to a time of responding at a point in time when a scheduled response is completed, accompanying a display of the corresponding radio-communication marker among the predetermined number of radio-communication markers displayed by means of the radio-communication marker generating unit, at least one of the first and second coordinates along the abscissa which is a time base of the first and second coordinates displayed by means of the coordinate generating unit.

6. The test system for a mobile communication terminal, according to claim 2, wherein the message log acquiring unit comprises a storage unit which

acquires and analyzes message information when the transmission/reception unit and the mobile communication terminal exchange the respective predetermined messages, thereby storing at least a part of or a text of the message information so as to be read, and

the display control unit has:

a designation marker generating unit which generates a designation marker that moves in accordance with a selective designation of an operator along the abscissa which is a time base of the second coordinate displayed by means of the coordinate generating unit, and causes to display at least one of the predetermined number of radio-communication markers displayed by means of the radio-communication marker generating unit; and

a message display control unit which, when a specific radio-communication marker among the predetermined number of radio-communication markers is designated by the designation marker displayed by means of the designation marker generating unit, reads out at least a part of or a text of message information corresponding to the specific radio-communication marker from the storage unit of the message acquiring unit and causes to display it on the display unit.

7. The test system for a mobile communication terminal, according to claim 1, wherein the reception measurement unit includes a spectrum analyzer having a

function of analyzing and measuring a response signal from the mobile communication terminal at a time domain.

8. The test system for a mobile communication terminal, according to claim 2, wherein the test procedure control unit has a computer and computer readable program code means for causing the computer to carry out a transition test for a connection state of the mobile communication terminal of the cellular system, and outputs control information including time setting information in accordance with the computer readable program code means.

9. The test system for a mobile communication terminal, according to claim 8, wherein the determining unit, the message log acquiring unit, and the display control unit are organized together with the test procedure control unit as software of the computer.

10. The test system for a mobile communication terminal, according to claim 9, wherein the computer readable program code means has:

first computer readable program code means for causing the transmission/reception unit to generate a plurality of test signals including predetermined messages corresponding to a plurality of cells in the cellular system in accordance with the control information from the test procedure control unit, and to vary the plurality of test signals in accordance

with a scheduled time passage to thereby transmit the signals to the mobile communication terminal and receive response signals including the predetermined messages from the mobile communication terminal;

second computer readable program code means for causing the reception measurement unit to measure time domain waveforms of the response signals including the predetermined messages from the mobile communication terminal;

third computer readable program code means for causing the message log acquiring unit to acquire and store messages and the radio-communication time information when the transmission/reception unit and the mobile communication terminal exchange the respective predetermined messages;

fourth computer readable program code means for causing the display unit to display measured results of the time domain waveforms from the reception measurement unit and the radio-communication time information from the message log acquiring unit; and

fifth computer readable program code means for causing the display control unit to carry out processing for receiving the measured results of the time domain waveforms from the reception measurement unit and the radio-communication time information from the message log acquiring unit, and to display graphs indicating the measured results of the time

domain waveforms and a predetermined number of radio-communication markers indicating points in radio-communication time which correspond to the radio-communication time information by a graphic display capable of simultaneously comparing at both sides on the same time base on the display unit.

11. The test system for a mobile communication terminal, according to claim 10, wherein the computer readable program code means further has:

sixth computer readable program code means for causing the coordinate generating unit to divide a display screen of the display unit into at least a first region and a second region, and to display a first coordinate where the abscissa is time and the ordinate is power level on the first region, and a second coordinate where the abscissa is a time base which is the same as the abscissa of the first coordinate and the ordinate is respective positions of the mobile communication terminal and the plurality of cells on the second region;

seventh computer readable program code means for causing the data display control unit to display the graphs indicating the measured results of the time domain waveforms at the first coordinate displayed by means of the coordinate generating unit; and

eighth computer readable program code means for causing the radio-communication marker generating

unit to display the predetermined number of radio-communication markers indicating points in radio-communication time which correspond to the radio-communication time information along the abscissa which is a time base of the second coordinate displayed by means of the coordinate generating unit.

12. The test system for a mobile communication terminal, according to claim 11, wherein the computer readable program code means further has:

ninth computer readable program code means for causing the radio-communication marker generating unit to display, as the predetermined number of radio-communication markers, between the respective positions of the mobile communication terminal and the plurality of cells at the second coordinate, capable of recognizing at least one of down radio-communication from the mobile communication terminal to one of the cells and up radio-communication from one of the cells to the mobile communication terminal, and capable of recognizing the points in radio-communication time which correspond to the radio-communication time information along the abscissa which is a time base of the second coordinate.

13. The test system for a mobile communication terminal, according to claim 12, wherein the computer readable program code means further has:

tenth computer readable program code means

for causing the reception measurement unit to, in accordance with a response signal from the mobile communication terminal, measure a transition time that until it is switched from a state in which the mobile communication terminal receives a first test signal showing a greater strength at a current point in time among the plurality of test signals to a state in which the mobile communication terminal receives a second test signal having a second greater strength among the plurality of test signals accompanying that the plurality of test signals are varied to be successively made to be a greater strength in accordance with the scheduled time passage;

eleventh computer readable program code means for causing a determining unit to, upon receiving the measured results of the transition time from the reception measurement unit, carry out success/failure determination as to whether a transition has been a success or a failure in which the mobile communication terminal is switched from a state of receiving the first test signal among the plurality of test signals corresponding to the plurality of cells to a state of receiving the second test signal in accordance with the control information from the test procedure control unit; and

twelfth computer readable program code means for causing the data display control unit to display

capable of recognizing a success/failure as a result of the success/failure determination by the determining unit together with a corresponding radio-communication marker among the predetermined number of radio-communication markers displayed by means of the radio-communication marker generating unit.

14. The test system for a mobile communication terminal, according to claim 13, wherein the computer readable program code means further has:

thirteenth computer readable program code means for causing the data display control unit to display capable of recognizing states from a start up to a time of responding at a point in time when a scheduled response is completed, accompanying the display of a corresponding radio-communication marker among the predetermined number of radio-communication markers displayed by means of the radio-communication marker generating unit, at least one of the first and second coordinates along the abscissa which is a time base of the first and second coordinates displayed by means of the coordinate generating unit.

15. The test system for a mobile communication terminal, according to claim 14, wherein the computer readable program code means further has fourteenth computer readable program code means for causing the storage unit of the message log acquiring unit to acquire and analyze message information when the

transmission/reception unit and the mobile communication terminal exchange the respective predetermined messages, thereby storing at least a part of or a text of the message information to be read.

16. The test system for a mobile communication terminal, according to claim 15, wherein the computer readable program code means further has:

fifteenth computer readable program code means for causing the designation marker generating unit of the display control unit to move in accordance with a selective designation by an operator along the abscissa which is a time base of the second coordinate displayed by means of the coordinate generating unit, and generate a designation marker identifying at least one of the predetermined number of radio-communication markers displayed by means of the radio-communication marker generating unit to be designated; and

sixteenth computer readable program code means for causing the message display control unit of the display control unit to, when a specific radio-communication marker among the predetermined number of radio-communication markers is designated by the designation marker displayed by means of the designation marker generating unit, read out at least a part of or a text of the message information corresponding to the specific radio-communication marker from the message acquiring unit, and to display it on the display unit.

17. A test method for a mobile communication terminal, comprising:

a step of preparing a test procedure control unit which possesses a procedure for carrying out a transition test for a connection state of a mobile communication terminal of a cellular system, and outputting control information including time setting information in accordance with the procedure from the test procedure control unit;

a step of preparing a transmission/reception unit, and in accordance with the control information from the test procedure control unit, generating a plurality of test signals including predetermined messages corresponding to a plurality of cells in the cellular system, and varying the plurality of test signals in accordance with a scheduled time passage to thereby transmit the signals to the mobile communication terminal and receive a response signal including a predetermined message from the mobile communication terminal in the transmission/reception unit;

a step of preparing a reception measurement unit, and measuring a time domain waveform of the response signal including the predetermined message from the mobile communication terminal in the reception measurement unit;

a step of preparing a message log acquiring unit, and acquiring and storing messages and

radio-communication time information when the transmission/reception unit and the mobile communication terminal exchange respective messages by means of the message log acquiring unit;

a step of preparing a display unit, and displaying measured results of the time domain waveforms from the reception measurement unit, and the radio-communication time information from the message log acquiring unit on the display unit; and

a step of preparing a display control unit, and carrying out processing for receiving the measured results of the time domain waveforms from the reception measurement unit and the radio-communication time information from the message log acquiring unit, and for causing to display graphs indicating the measured results of the time domain waveforms and a predetermined number of radio-communication markers indicating points in radio-communication time which correspond to the radio-communication time information by a graphic display capable of simultaneously comparing at both sides of the same time base on the display unit by means of the display control unit.

18. The test method for a mobile communication terminal, according to claim 17, wherein the test procedure control unit has a computer and computer readable program code means for causing the computer to carry out a transition test for a connection state

of the mobile communication terminal of the cellular system, and outputs control information including time setting information in accordance with the computer readable program code means.

19. The test method for a mobile communication terminal, according to claim 18, wherein the message log acquiring unit and the display control unit are organized together with the test procedure control unit as software of the computer.

20. The test method for a mobile communication terminal, according to claim 19, wherein the computer readable program code means has:

first computer readable program code means for causing the transmission/reception unit to, in accordance with the control information from the test procedure control unit, generate a plurality of test signals including predetermined messages corresponding to the plurality of cells in the cellular system, and vary the plurality of test signals in accordance with a scheduled time passage to thereby transmit the signals to the mobile communication terminal and receive response signals including the predetermined messages from the mobile communication terminal;

second computer readable program code means for causing the reception measurement unit to measure time domain waveforms of the response signals including the predetermined messages from the mobile communication

terminal;

third computer readable program code means for causing the message log acquiring unit to acquire and store messages and radio-communication time information when the transmission/reception unit and the mobile communication terminal exchange the respective predetermined messages;

fourth computer readable program code means for causing the display unit to display measured results of the time domain waveforms from the reception measurement unit and the radio-communication time information from the message log acquiring unit; and

fifth computer readable program code means for causing the display control unit to carry out processing for receiving the measured results of the time domain waveforms from the reception measurement unit and the radio-communication time information from the message log acquiring unit, and for causing to display graphs indicating the measured results of the time domain waveforms and a predetermined number of radio-communication markers indicating points in radio-communication time which correspond to the radio-communication time information by a graphic display capable of simultaneously comparing at both sides on the same time base on the display unit.

21. The test method for a mobile communication terminal, according to claim 20, wherein the computer

readable program code means further has:

sixth computer readable program code means for causing a coordinate generating unit of the display control unit to divide a display screen of the display unit into at least a first region and a second region, and to display a first coordinate where the abscissa is time and the ordinate is power level on the first region, and a second coordinate where the abscissa is a time base which is the same as the abscissa of the first coordinate and the ordinate is respective positions of the mobile communication terminal and the plurality of cells on the second region;

seventh computer readable program code means for causing a data display control unit of the display control unit to display graphs indicating the measured results of the time domain waveforms at the first coordinate displayed by means of the coordinate generating unit; and

eighth computer readable program code means for causing a radio-communication marker generating unit of the display control unit to display a predetermined number of radio-communication markers indicating points in radio-communication time which correspond to the radio-communication time information along the abscissa which is a time base of the second coordinate displayed by means of the coordinate generating unit.

22. The test method for a mobile communication

terminal, according to claim 21, wherein the computer readable program code means further has:

ninth computer readable program code means for causing the radio-communication marker generating unit of the display control unit to display capable of recognizing, as the predetermined number of radio-communication markers, between the respective positions of the mobile communication terminal and the plurality of cells on the ordinate at the second coordinate, at least one of down radio-communication from the mobile communication terminal to one of the cells and up radio-communication from one of the cells to the mobile communication terminal, and capable of recognizing the points in radio-communication time which correspond to the radio-communication time information along the abscissa which is a time base of the second coordinate.

23. The test method for a mobile communication terminal, according to claim 22, wherein the computer readable program code means further has:

tenth computer readable program code means for causing the reception measurement unit to, in accordance with the response signals from the mobile communication terminal, measure a transition time that until it is switched from a state in which the mobile communication terminal receives a first test signal showing a greater strength at a current point in time among the plurality of test signals to a state in which

the mobile communication terminal receives a second test signal having a second greater strength among the plurality of test signals accompanying that the plurality of test signals are varied to be successively made to be a greater strength in accordance with the scheduled time passage;

eleventh computer readable program code means for causing the determining unit to, upon receiving the measured results of the transition time from the reception measurement unit, carry out success/failure determination as to whether a transition has been a success or a failure in which the mobile communication terminal is switched from a state of receiving the first test signal among the plurality of test signals corresponding to the plurality of cells to a state of receiving the second test signal in accordance with the control information from the test procedure control unit; and

twelfth computer readable program code means for causing the data display control unit of the display control unit to display capable of recognizing a success/failure as the result of the success/failure determination by the determining unit together with a corresponding radio-communication marker among the predetermined number of radio-communication markers displayed by means of the radio-communication marker generating unit.

24. The test method for a mobile communication terminal, according to claim 23, wherein the computer readable program code means further has:

thirteenth computer readable program code means for causing the data display control unit to display capable of recognizing states from a start up to a time of responding at a point in time when a scheduled response is completed, accompanying the display of a corresponding radio-communication marker among the predetermined number of radio-communication markers displayed by means of the radio-communication marker generating unit, at least one of the first and second coordinates along the abscissa which is a time base of the first and second coordinates displayed by means of the coordinate generating unit.

25. The test method for a mobile communication terminal, according to claim 24, wherein the computer readable program code means further has:

fourteenth computer readable program code means for causing the storage unit of the message log acquiring unit to acquire and analyze message information when the transmission/reception unit and the mobile communication terminal exchange the respective predetermined messages, thereby storing at least a part of or a text of the message information to be read.

26. The test method for a mobile communication

terminal, according to claim 25, wherein the computer readable program code means further has:

fifteenth computer readable program code means for causing the designation marker generating unit of the display control unit to move in accordance with a selective designation by an operator along the abscissa which is a time base of the second coordinate displayed by means of the coordinate generating unit, and to generate a designation marker identifying at least one of the predetermined number of radio-communication markers displayed by means of the radio-communication marker generating unit to be designated; and

sixteenth computer readable program code means for causing the message display control unit of the display control unit to, when a specific radio-communication marker among the predetermined number of radio-communication markers is designated by the designation marker displayed by the designation marker generating unit, read out at least a part of or a text of the message information corresponding to the specific radio-communication marker from the message acquiring unit, and to display it on the display unit.